

SCIENCE

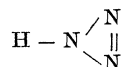
NEW YORK, JULY 7, 1893.

HYDRAZOIC ACID: A NEW FORM OF APPARATUS FOR ITS PREPARATION; ITS PHYSIOLOGICAL ACTION.

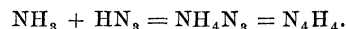
BY CYRIL G. HOPKINS, SOUTH DAKOTA AGRICULTURAL COLLEGE, BROOKINGS, SOUTH DAKOTA.

MOST of the text-books on the subject of chemistry in use at the present time still recognize but one compound of hydrogen and nitrogen, viz., ammonia. There are, however, now known to science, several compounds of these two elements. Of these the most important are ammonia, NH_3 ; hydrazoic acid, HN_3 ; and hydrazine, N_2H_4 . There is a remarkable difference in the properties of the first two substances. Ammonia, the volatile alkali, has very strong basic properties, uniting directly with acids to form the ammonium salts. Only with the strongest basic elements does it act like an acid, forming sodium amide, NaNH_2 , with sodium, and potassium amide, KNH_2 , with potassium.

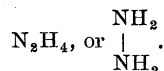
Hydrazoic acid, on the contrary, is a comparatively strong acid. Being a binary compound of hydrogen and nitrogen, it might well be called *hydronitric* acid, after the analogy of hydrochloric acid, hydrobromic acid, etc. Its structural formula is represented thus:—



Its hydrogen atom is readily replaced by metals and radicals, the salts of hydrazoic acid being thus formed. The ammonium salt contains only hydrogen and nitrogen, and is formed by direct union of ammonia and hydrazoic acid:—



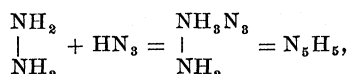
Hydrazoic acid also unites with hydrazine, another compound of hydrogen and nitrogen, possessing the formula



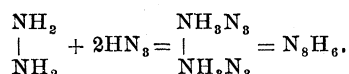
This substance, hydrazine, or diamine, as it is sometimes called, bears to ammonia the same relation that ethane, C_2H_6 , or $\begin{array}{c} \text{CH}_3 \\ | \\ \text{C}_2\text{H}_6, \text{ or } | \\ \text{CH}_3 \end{array}$,

bears to marsh gas, CH_4 ; or that diphenyl, $\begin{array}{c} \text{C}_6\text{H}_5 \\ | \\ \text{C}_6\text{H}_5 \end{array}$, bears to benzene, C_6H_6 .

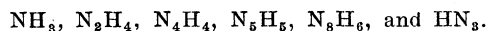
Like ammonia, hydrazine possesses strong basic properties. With hydrazoic acid it forms two compounds by direct addition:—



and



Thus we have at least six compounds of the elements hydrogen and nitrogen, their general formulas being:—



Heretofore hydrazoic acid and its derivatives have been made only by reactions¹ of organic chemistry; but within the past few months a method has been devised by Wislizenus² by which the acid is made entirely from inorganic substances. This is done by first treating molten metallic sodium (or potassium) with dry ammonia gas, and then treating the sodium amide thus formed

with dry nitrous oxide. The sodium salt of hydrazoic acid is thus formed; and, by treating this with dilute sulphuric acid, the hydrazoic acid itself is liberated, and may then be distilled off with water, thus giving a dilute aqueous solution.

Wislizenus performed the operation in a small porcelain boat within a glass tube. The porcelain is strongly attacked by the sodium compounds, and the yield of hydrazoic acid which Wislizenus obtained was nearly 50 per cent of the theoretical amount, and, besides, only a small quantity of the acid (about one-half a gramme) could be made at a time.

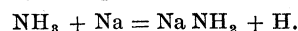
These objections to the apparatus used by Wislizenus induced the author to seek for a better form of apparatus with which to prepare the acid.

A cylindrical copper air-bath was selected, which was provided with two mica windows placed opposite each other, through which any operation that was carried on within the bath could be easily observed. The bath was about fifteen centimetres from top to bottom and of about an equal diameter. The cover was of heavy asbestos board. In the centre of this a large circular opening was made, through which a glass beaker of 750 cubic centimetres capacity was inserted into the bath until its rim rested upon the asbestos board, the bottom of the beaker not being allowed to touch the bottom of the bath. A small quantity of clean sand was placed in the bottom of the beaker, and upon this a small iron sand-bath, hemispherical in shape, and having a capacity of 100 cubic centimetres. The mouth of the beaker was closed with a large flat cork, provided with three holes. Through the central hole passes a glass tube which reaches a little way into the iron dish, and through which the gases are conducted into the apparatus. The second hole carries a short exit tube, and the third a thermometer.

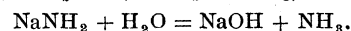
Neither the metallic sodium nor the compounds formed have any action upon the iron dish, and the reactions which take place in the dish can be readily observed through the mica windows of the air-bath and the glass beaker.

The ammonia gas was obtained by gently heating on a water-bath a flask containing strong ammonia water, and the nitrous oxide by the decomposition of ammonium nitrate by heat. The gases were dried as directed by Wislizenus, by passing them over soda-lime and solid potassium hydroxide.

To perform the operation 25 grammes of metallic sodium were placed in the iron dish, the temperature of the bath raised to $300^\circ - 360^\circ \text{C.}$, and dry ammonia gas conducted in and delivered just above the surface of the molten sodium. The specific gravity of sodium being less than that of the amide formed, the metal floats on the surface until the action is finished. The reaction is represented by the equation:—



When the globules of sodium had all disappeared, the nitrous oxide was substituted for the ammonia, and the temperature of the bath lowered to $230^\circ - 250^\circ \text{C.}$ Two reactions now take place. The two atoms of hydrogen in the sodium amide are replaced by the bivalent group, N_2 , contained in the nitrous oxide, the hydrogen and oxygen uniting to form water. This then reacts with a second molecule of sodium amide, forming sodium hydroxide and ammonia:—



The sodium compounds have a strong tendency to creep over the edge of the iron dish as fast as they are formed; but they only fall upon the sand in the bottom of the beaker, from which they are readily dissolved out by water.

When the odor of ammonia ceases to be given off, the reaction is complete. The apparatus was allowed to cool, the mixture of sodium hydroxide and the sodium salt of hydrazoic acid was dis-

¹ Berichte der deutsch. Chem. Gesellschaft (Curtius), xxiii., 3023; xxiv., 3245. Ibid (Noetting and Grandmougin), xxiv., 2546.

² Ibid, xxv., 2084.

solved in 500 cubic centimetres of water, and then dilute sulphuric acid added till the hydrazoic acid was liberated. The solution was then distilled till the distillate ceased to give a precipitate with silver nitrate.

The distillate was then diluted to a definite volume and its strength determined by titration with standard ammonia solution. The yield of the acid was 87 per cent of the theoretical, 500 cubic centimetres of nearly 4 per cent solution being obtained.

A part of the acid solution was neutralized with potassium carbonate, and evaporated to crystallization. Beautiful, tabular, transparent crystals of the potassium salt, KN_3 , were formed.

The salts of hydrazoic acid, excepting the salts of the alkali metals and the metals of the alkaline earths, are explosive. In some respects the acid resembles hydrochloric acid. With soluble silver salts a white precipitate, AgN_3 , is formed. Lead acts similarly. These salts explode very violently when heated.

The most remarkable property of hydrazoic acid and its soluble salts is their physiological action. In this respect they resemble the nitrite of amyl, $\text{C}_5\text{H}_{11}\text{NO}_2$, having a marked influence upon the action of the heart. The author found by experiment that one-tenth of a grain of the potassium salt, KN_3 , dissolved upon the tongue (the resulting solution not being swallowed, but ejected from the mouth) was sufficient to increase the pulse from 96 beats per minute to 153. This required only five minutes' time after the dose was taken. This rate of heart-beat is not sustained, however. A sudden and rapid reduction takes place, and ten minutes after the dose was taken the heart was giving 60 feeble beats per minute, making a total variation of 97 beats per minute. Considering the fact that this effect was produced by the small quantity of the substance which was absorbed by the mucous membrane of the tongue, this property is certainly remarkable. The vapors of the hydrazoic acid produce similar effects when inhaled.

The laboratory work reported in this article was performed in the chemical laboratory of Cornell University; and the author wishes to acknowledge that the success of the work was largely due to the aid and direction given by Dr. W. R. Orndorff. Thanks are also due him for his kindness in reading and correcting the manuscript.

ON PROTOPTERUS ANNECTENS.

BY DR. R. W. SHUFELDT, WASHINGTON, D.C.

THERE has been very recently published in the Transactions of the Royal Irish Academy (Vol. XXX., Part III., pp. 109-230, Plates vii. to xvii.) the long-delayed work of Professor W. N. Parker of the University College, at Cardiff, Wales, "On the Anatomy and Physiology of *Protopterus annectens*." Through the courtesy of its author, a reprint of that most valuable quarto is now before me, and it is my wish to write a brief notice here in regard to it. The elaborate manner in which the Transactions of the Academy are published is too well known to require remark, but in the present instance it is impossible to pass this work without a word upon the truly superb plates that illustrate it. These, some ten in number, were chromo-lithographed by Professor Parker's younger brother, M. P. Parker, and printed by West, Newman. They present us with much of the anatomy and histology of *Protopterus*, and are throughout perfect masterpieces of the kind, and of the very highest order of merit.

As is well known, this genus formerly was written *Lepidosiren*, the South American species being *L. paradoxa*, and the African one *L. annectens*,¹ and among the first to pay any attention to it, of a reliable nature, was Sir Richard Owen, who, in 1839-1841,

¹ Dr. Günther classifies them as follows:—

Suborder III.		Families.	Genera.
ORDER II.—Ganoidei {	Dipnoi.	1. Sirenidae	{ <i>Lepidosiren</i> , incl. <i>Protopterus</i> and <i>Ceratodus</i> .
		2. Ctenodontidae	{ Two extinct genera, <i>Dipnoterus</i> and <i>Heliodus</i> .
		3. Phancropleuridae	{ Extinct <i>Phancropleuron</i> .

And he remarks that "Two species are known, *L. paradoxa*, from the system of the river Amazon, and *L. (Protopterus) annectens*, which abounds in many localities of the west coast of Africa, is spread over the whole of tropical Africa, and in many districts of the central parts forms a regular article of diet."

published his "Description of *Lepidosiren annectens*" in the Transactions of the Linnæan Society of London (Vol. XVIII.), since which time naturalists have never ceased to furnish various accounts of the biology of this extremely important form, but usually based, as Professor Parker remarks, upon badly preserved material. Our present author was far more fortunate as he had perfectly fresh specimens to work upon. Of these he has said in his "Introduction," that "All my material, with the exception of two specimens, purchased last autumn, were placed at my disposal by Professor Wiedersheim. These were received alive direct from the neighborhood of the Gambia, and to Dr. J. Beard is due the credit of having arranged for their transport. While in the torpid condition about one hundred specimens had been dug out, each surrounded by a clod of earth,² and the clods were then packed together in open crates. In this manner they travelled without harm, nearly all of them being alive and in a healthy condition on their arrival in Freiburg. On being removed from the clods, they were, by the kind permission of Professor Hildebrandt, placed in a large wire cage, sunk beneath the water in a basin used for the culture of water plants in one of the hot-houses of the Botanical Gardens, in which a constant temperature of 22.5° C. was maintained."³ . . . "Protopterus lives probably to a great age, and this supposition is supported by the somewhat incredible statement of the natives mentioned by Stuhlmann, that some specimens reach a length of six feet. From the observations of Hyrtl and Bischoff, it appears that *Lepidosiren* also attains a large size, reaching, at any rate, three feet in length" (p. 112).

It was found that *Protopterus* grows very rapidly, has great vitality, and, although able to sustain fasts, is exceedingly voracious, devouring all the abundant snails, earth-worms, and small fish given them, and then killing and eating each other, making it difficult in the extreme to preserve the specimens.

Protopterus is most active at night, and appears to keep mostly to the shallow water, where they move deliberately about on the bottom, alternately using the peculiar limbs of either side, though their movements do not seem to be guided by any strict regularity. "Gray has compared these movements with those of a Triton, and several other observers have noticed them. The powerful tail forms a most efficient organ for swimming rapidly through the water."

"It is well known that *Protopterus* comes to the surface to breathe at short intervals, and thus it is evident that the lungs perform an important, if not the chief, part in respiration during the active life of the animal. The air passes out again through the opercular aperture, and the movements of the operculum itself indicate the fact that bronchial as well as pulmonary respiration takes place."

Externally, the sexes present no characters whatever distinguishing them apart, and even in immature specimens it is difficult to tell ovary from testis.

In the present brief notice it will be impossible for us to even abstract the positive advances Professor Parker has made for us in our knowledge of both the anatomy and physiology of this instructive Dipnoan. He sums up handsomely on page 213, under his "General Abstract, Summary of Chief Results, and Conclusions."

His researches convince him that, although many points of resemblance exist between *Protopterus* and certain Elasmobranchs and Ganoids on the one hand, and on the other to some of the lower Amphibians, it exhibits numerous distinctive characters of its own, both primitive and specialized, and so, together with *Lepidosiren* and *Ceratodus*, must be placed at a great distance from either class. Further, he believes that the Dipnoi, as a group, should not be retained among the fishes, still less among the Amphibia.

² To those less familiar with the habits of this extraordinary fish, I would say that the species averages about four feet in length, and is an inhabitant of the Gambia River in Africa. They bury themselves in the mud during the dry season, making a kind of nest in which they pass a period of torpidity. Here they may remain for the best part of the year, but on the return of the wet season resume again their aquatic mode of life.

³ In 1839, it will be remembered, Stuhlmann also gave an interesting account of *Protopterus*, published in German. (Berlin.)

The most common of all our species is *C. serrulatus*. Rarely is a collection without this form, which seems to adapt itself easily to very different surroundings. It has, however, wide

limits of variation, and it is, perhaps, due to this fact that it is so universally distributed. The littoral and pelagic forms are so different that they have been considered specifically distinct.

C. modestus is a rare form. Thus far it has been found in only a single locality in Wisconsin.

None of the American species of *Diaptomus* is identical with those of Europe, although in some cases the relationship is very close.

D. sicilis is the common pelagic form of the Great Lakes, but occurs also in smaller bodies of water. *D. ashlandi* has been found only in the Great Lakes.

The most common species in the smaller lakes is *D. oregonensis*. This was described by Lilljeborg from specimens collected in Oregon, and probably is common through our northern States. *D. minutus* is common in Newfoundland, Greenland and Iceland. It occurs in some of the small lakes in northern Wisconsin and in Green Lake. It is likely that it occurs quite generally through the northern part of North America, and possibly central Wisconsin is near its southern limit.

Especial interest attaches to the fauna of Green Lake. This is about seven miles long, with a maximum depth of nearly two hundred feet. While the pelagic fauna of the Great Lakes is quite distinct from that of the smaller lakes, we find in Green Lake both sets of faunæ. *D. sicilis* and *Limnocalanus macrurus* I have not found outside the Great Lakes except in Green Lake. But besides these species the pelagic fauna of Green Lake includes *C. brevispinosus* and *C. fluviatilis*, which are the characteristic species of the smaller lakes.

A more detailed account of the Wisconsin copepoda will soon appear in the Transactions of the Wisconsin Academy.

THE HILLOCK AND MOUND FORMATIONS OF SOUTHERN CALIFORNIA.

BY DANIEL CLEVELAND, SAN DIEGO, CALIFORNIA.

SOME time ago, in an article upon the nest of the trap-door spider, which appeared in *Science*, I mentioned the low mounds in which these nests in many districts are so often located, as being in themselves an interesting formation. I now propose to offer an explanation of the origin of the formation.

Let me begin by saying that these mounds are not confined to this vicinity, for they extend throughout this State and elsewhere on this coast and in Texas; but they are more numerous and better defined here than elsewhere; they are, in fact, a characteristic of certain large areas of our territory. For this reason, among others, I believe this to be the best field for observing and investigating this remarkable formation.

Lying just back of the commercial portion of the city of San Diego there is a great mesa or table-land, which stretches away for a distance of from eight to ten miles to the valleys at the base of the Coast Range. It possesses a rich brown soil, holding in many places considerable aggregations of loose stones which have drifted down from the neighboring mountains and been ground into pebbles. Here for miles the surface is gently undulating, with low mounds lying as close together and as numerous, considering their size, as the ground will permit. These mounds are from one to three feet in height above their bases, and are from ten to thirty feet in diameter, separated by greatly varying areas which in their depressions in many places contain accumulations of cobble stones. An unscientific person seeing these plains for the first time might imagine that they had once been densely populated by large burrowing animals which had left these hillocks to mark their subterranean dwellings.

Several theories have been advanced to account for this formation. The most probable hypothesis is suggested by the nature of the soil and the peculiar vegetation of these plains. The soil itself is dry and hard for the six to eight months constituting the rainless season. During the time of heavy rains it is soft and mellow. During the time of drought it becomes almost as hard as stone.

Each mound, it is evident enough, marks the former home of a shrub or, as was almost always the case, of a cluster of shrubbery, to whose agency the mound in large degree owed its existence. Three shrubs—*Rhus laurina*, Nutt.; *Simmondsia Californica*, Nutt.; and *Isomeris arborea*, Nutt.—are conspicuous among the large vegetation of these plains, and have been very important factors in the formation of these mounds. Of these plants *Rhus laurina* is the largest and is much more abundant than the other two. It is an interesting fact that these three shrubs are confined to this section of California, mostly to this county, and that they were all first collected at San Diego about 1840, and were named by the eccentric naturalist Thomas Nuttall. He established the genera *Simmondsia* and *Isomeris*. The habits of these plants peculiarly fit them for their office of mound builders. They grow in small compact groups. Many stems rise from the roots, which are large and spreading. The foliage of *Rhus* and *Simmondsia* especially is dense and falls close to the ground.

Dust blown by the steady trade winds of the dry season is arrested by the shrub and accumulates with the fallen leaves at its base, making a steady accretion of material. In this way a mound gradually rises about the plant, in time covering the lower branches and in the case of the smaller shrubs—*Simmondsia* and *Isomeris*—nearly or quite enveloping the whole plant. This process of mound building can still be seen in isolated hillocks. An examination of the older mounds confirms this theory. In the lower portion of the mound the earth is compact and indurated, while the surface soil is a light loam mixed with decayed and decaying leaves. The mound is protected from washing by the rains at the summit by the overhanging branches and foliage, and at the base by a compact mass of roots. Outside of the foliage and roots the process of erosion goes on steadily, though slowly, during the rainy season, when this soil is peculiarly susceptible to the action of water, and the hollows between the mounds are then formed.

When in the course of time the plant dies from natural decay, from being smothered by the drift that environs it or from the fires that sometimes sweep over these plains, the mounds, being deprived of protection, are attacked by wind and rain and gradually worn down. The mounds are thus made shallower and broader at the base, until from this steady subsidence they sink down and flatten out almost to the general level of the plain.

The presence of living shrubs upon the more perfect mounds and of masses of roots well preserved or in process of decay in mounds in subsidence, where no large growing vegetation has been seen for many years, and in the oldest and flattest mounds the disappearance of all traces of shrubs and roots, confirm our theory of mound formation and subsidence.

What the shrubs I have named—*Rhus*, *Simmondsia* and *Isomeris*—have effected in coöperation with the wind and rain in the formation of mounds in this section, has been accomplished elsewhere by other shrubs and trees. It is a familiar fact that upon the great prairies of Texas mats of timber are generally found upon the summit of hillocks, very much larger, of course, than the mounds of southern California, as those trees are larger than our shrubs.

CURRENT NOTES ON ANTHROPOLOGY. — XXXI.

[Edited by D. G. Brinton, M.D., LL.D., D.Sc.]

The Archæology of Oaxaca.

Two or three years ago the State of Oaxaca, in Mexico, established an Archæological Museum, and placed it in charge of the very competent and enthusiastic scientist, Dr. Nicolas Leon, of Michoacan, who had already won for himself a wide reputation as curator of the Museum at Morelia. Through some unfortunate political changes the modest appropriations awarded to both these institutions have been diverted into other channels. This is a matter of great regret to all who are interested in the preservation of the ancient monuments of Mexico and the further investigations into the numerous remains there found.

The State of Oaxaca especially has an archæological importance which attaches a unique value to the investigation of its remains. From the earliest days of which tradition records the echoes, it was the home of the Zapotecs, and the profoundest researches into the pre-Columbian origin of the Aztec and Mexican civilization point, not to the fabulous "Empire of the Toltecs," but to these Zapotecs as the tribe which first spread abroad

the light of a higher culture, who invented the famous sacred calendar, so long the subject of astonishment to the learned, and who constructed edifices of brick and stone whose massive walls, strange ornamentation and remarkable architectural details, place them among the most impressive of any on the continent.

One of these was described, not for the first time, but with considerable care, by the engineer Aureliano Estrada, in the *Memorias de la Sociedad Científica Antonio Alzate*, of Mexico, last year. It is a mass of buildings crowning the summit of the Cerro de Quiengola, a mountain some 2,500 feet in height in the District of Tehuantepec. It presents thick walls of stone and burnt brick, circular and square towers, truncated pyramids and all the proofs of an extensive population.

It is sincerely to be hoped that these and numerous other remains in this state will be protected from destruction and thoroughly examined to the benefit of science.

The Basques and the Iberians.

An unusual number of papers and essays on questions relating to the ethnic position of the Basques and their possible relationship to the ancient Iberians, have appeared in France within the last year.

First, the linguists have had much to say. It is well known that Wilhelm von Humboldt in the first decade of the present century wrote an admirable analysis of the place-names throughout Spain, showing, he believed, by them, that the Basques at the time of the Roman conquest extended westward from the Pyrenees to the Atlantic coast. His conclusions have been alternately accepted and denied by special students of the tongue, and so they are to-day. Professor Julien Vinson, for example, a distinguished Basque scholar, says: "There is no historic proof, nor even scientific probability, that the Basque at any time occupied a much larger area than at present. The opinion that the Iberian peninsula or other parts of southwestern Europe were peopled by a race or races speaking a kindred dialect is based merely on etymologies, and must be considered a pure hypothesis."

Directly the contrary is maintained by M. J. F. Bladé, who observes: "Inasmuch as, in a large area surrounding the present territory of the Basques, altars are almost daily found inscribed to gods unknown among the Celts, and tombs bearing names certainly not Celtic, the conclusion appears justified that these names are ancient Basque, and that this tongue once spread over Aquitania and Iberia."

Meanwhile, the physical anthropologists have been at work. Dr. Lajard, in the *Bulletin of the Anthropological Society of Paris*, published the results of a comparison of ancient and modern skulls in the Canary Islands, with a large number from Portugal and Spain; reaching the result, that not only was the race of the Guanches of the Canaries identical with that of the old Iberians, but that both point to the still older race of Cro-Magnon, as their near relatives. This does not take in the Basques, but leaves them to one side; while, as we certainly know that the Guanches were blonde Hamites, closely akin to the Rifians at Morocco, it places the Iberians along with the North Africans.

As for the present Basque population, they are reported by M. De Cartailhac as losing their language and diminishing in number. Even in the most remote and secluded districts, the deaths are more numerous than the births, owing to the rarity of marriages; and French and Spanish are in a fair way to drive out this curious and venerable tongue from its last refuge in the fastnesses of the Pyrenees.

Man in South America.

There is no part of the world that offers a more curious subject of speculation as to its future than the continent of South America, as was well set forth in an address before the American Geographical Society, by its President, Mr. Gardiner G. Hubbard.

That the Amazon river system alone drains a basin of fertile land, basking under a climate of perpetual summer, greater in area than the whole of Europe, is an astounding fact in itself. This vast territory is practically uninhabited. Its aboriginal

population is disappearing, or has disappeared, and the whites who in sparse number take their place, scarcely pretend to come with the expectation of remaining. There are tracts as large as the whole of France, of which we know less than of any equal area on the globe. Tribes of men are living there who are yet absolutely in the Stone Age, and who, even by barter or distant rumor, never heard of the European race or the use of metals.

The question up to which Mr. Hubbard leads his reader is second in importance to none in anthropology—that of acclimation. Is it possible for the white race, when it shall be endowed with all the resources of art and science which it is soon to have in its grasp, successfully to fight against the terrible odds of a tropical climate? He quotes in his favor the words of the historian, Buckle, and the naturalist, Bates; he might have added others of weight; but it cannot be doubted that most of the medical observers who have devoted themselves to this vast inquiry, lean to the opinion that never will the white race flourish under tropical skies.

NOTES AND NEWS.

THE fifth summer meeting of the Geological Society of America will be held Tuesday and Wednesday, August 15 and 16, in the Geological Lecture Room, Science Hall, University of Wisconsin. On account of the World's Congress of Geologists convening in Chicago, August 24, an invitation will be sent to geologists residing outside of North America to attend this meeting and present papers. A meeting of exceptional interest is anticipated. Fellows desiring to read papers should send titles and abstracts not later than July 15, in order to secure insertion in the preliminary list of papers. Matters for the programme, distributed at the first session, should be sent in by August 10. The meeting-room has facilities for lantern views, and members are invited to bring such illustrations. Matter sent by express or mail may be addressed in care of the Secretary, Room 32, Science Hall, University of Wisconsin, Madison, Wis. Packages should be clearly marked with the sender's name and prepaid. The excursions offered to the Fellows of the Geological Society of America are as follows: To the Lake Superior Region, to Devil's Lake, to the Dells of the Wisconsin, and to the Driftless Area.

—The Pope Manufacturing Company, of Boston and Hartford, makers of the Columbia bicycles, have engaged of late in a novel enterprise. They offered some time ago to give one of their bicycles to the school teacher who should be most successful in detecting errors in the school books in use in this country, provided the errors were determined to be such either by the authors and publishers of the books or by an impartial board of examiners. Typographical mistakes and disputed points in history and opinion were not to be included, but only errors of fact or of statement which could be shown to be such. Responses came from all parts of the country and the company have already awarded several of their bicycles to the persons who complied with the conditions of the gift. The kind of errors detected may be learned from the pamphlet entitled "Errors in School Books," which the Pope Company have issued, and which has now appeared in a second edition. Some of the errors are hardly more than ambiguous statements; others are erroneous dates; while others still are misstatements of scientific fact, as, for instance, the statement in a geographical work that the earth moves around the sun in a circle. Most of the publishers took the criticisms good naturedly, and whenever they were shown to be well founded corrected the books accordingly. The Pope Company have now renewed their offer of a bicycle to each of the five persons who shall send them the greatest number of errors in school books before September 1, 1893, the present competition to be open to all persons and not to teachers alone. That errors in school books are specially mischievous is obvious, since the young people who use the books have not, as a rule, the means of detecting them, and though the class of errors to which the Pope Manufacturing Company have devoted themselves are not perhaps the worst, they are the most easily detected and proved, and we should be glad if this new enterprise might result in the exposure and correction of every one of them.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

NOTES ON THE FLORA OF LONG ISLAND.

BY SMITH ELY JELLIFFE, M.D., BROOKLYN, N.Y.

THE flora of Long Island is one of some degree of richness, which upon a casual observation would seem to be a somewhat anomalous statement, for it would appear that a sand waste a few miles wide and about a hundred miles in length would hardly be a place upon which a rich or abundant flora could flourish.

Long Island, so geologists tell us, is a portion of the terminal moraine of the glacier that stretched across the country from east to west; traversing the entire length of the island there is a rocky ledge, the so-called "back bone," from which the land falls in more or less steep descents to the north, and in long gradual slopes southward; the whole coast is rich in fresh and salt water marshes, which are more pronounced upon the southern coast.

The earliest notices upon the subject are to be found in a paper published in 1807, entitled "Plantæ Plandomensis," or a catalogue of the plants growing near Plandome, Queens County, by Caspar Wistar Eddy. In 1835, J. B. Zabriskie published a "List of Plants Growing near Erasmus Hall, Flatbush," and from 1843 to 1853 John Torrey M.D., in his publication on the "Flora of New York," included many Long Island plants. In 1874, E. S. Miller and D. W. Young published their "Catalogue of the Plants of Suffolk County," to which additions were made in the Bulletin of the Torrey Botanical Club. This journal also contains many notes upon the island flora. C. H. Peck, N. L. Britton, A. H. Hollick, Geo. D. Hulst, W. H. Rudkin, W. H. Leggett, J. L. Zabriskie, Mrs. E. G. Britton, Mrs. L. D. Pychouska, F. E. Tillinghast and others have contributed notes from time to time upon new or interesting plants found on the island.

In round numbers about 1500 phænogamous plants have been recorded; the work in the cryptogams has been scanty, yet the writer has records of upwards of 750 species, which promises much for the numerical value of this portion of the flora when more completely studied.

The most characteristic of the plants are found in the salt marshes and along the sands of the sea coast, here are a number of interesting grasses and sedges, including *Fuirena squarrosa*, *Heleocharis Robbinsii*, *rostellata* and *melanocarpa*, *Scirpus subterminalis*, *Rhynchospora nitens*, *Calamagrostis Nuttalliana*, *Glycenaspluitana*, *Eragrostis pectinacea* and others; the salt-loving plants as *Ranunculus cymbalaria*, *Lecheas*, *racemulosa*, minor and major; *Hudsonia tomentosa* in quantities and *H. ericoides*, though much rarer, *Prunus maritima* and several of the more common forms are constantly to be found at almost all points along the southern shore. In the fresher marshes *Spiranthes*, *Habenaria*, *Calopogon* and *Pogonia*. *Cypripedium* and *Goodyera* are intermingled with rush and sedge and grass.

Along the ridges and in the higher lands the Composites, Labiates and Graminæ are widely distributed, there seeming to be a nearly equal distribution throughout the three counties. In general, however, the plants found in Suffolk county are among the most characteristic, there being there some fifty or sixty plants that belong to the New Jersey pine-barren flora and whose presence is to be explained upon the geological grounds that this eastern portion of the island was at one time a portion of the Atlantic littoral plain. Among those plants found in Suffolk county, some of which are also to be met with in Queen county, there may be mentioned *Camelina sativa*, *Reseda luteola*, *Drosera longifolia* and *filiformis*, *Ascyrum stans* and *Crux andreeæ*, *Arenaria squarrosa*, *Polygala lutea*, *Quercus phellos*, *Cyperus dentatus* and *Cupressus thyoides*, as of more particular interest. Recent investigations by Dr. A. H. Hollick, of Columbia College, have been directed to a better understanding of this portion of the flora, and interested botanists are referred to his papers in the Transactions of the New York Academy of Sciences.

The knowledge of the cryptogamic flora is still in its infancy. The ferns are well known and comprise the majority of the common *Aspleniums* and *Aspidiums* with here and there a more or less uncommon form, as *Woodsia obtusa*, *Woodwardia angustifolia*. The Bryophytes are represented by over 100 species, and it is certain that twice that number will be found when the collectors are more numerous and alert. *Catharinea crispa* is one of the rarer plants that has been found. The list of lichens is far from complete, 60 species are recorded and hardly a rock lichen collected. The number of species of fungi is 250, also a new field. The best known of the lower cryptogams are the marine algæ, they having been studied from the time of Professor Bailey to the present. *Bostrychia rivularis*, *Callithamnion dietziae*, which Professor Farlow, from a study of the original specimens in the herbarium of the Long Island Historical Society, is disposed to regard as a var. *laxa* of *C. Baileyi*, *Callithamnion tenue* are a few of those interesting algæ that are more or less uncommon. The diatoms are represented by a list of 78 species, which, with 45 species of fresh-water algæ, completes the numerical enumeration of the island's flora. Figures, however, are totally inadequate to express the characteristics of the flora of any region, however sparse it may be in vegetation, and it is hoped that in the near future a flora of Long Island will be in sufficiently advanced condition to warrant its publication, at least the portion recording the distribution of the phænogamous plants.

CONSUMPTION AMONG THE COLORED PEOPLE OF THE SOUTHERN STATES.

BY G. W. HUBBARD, M.D., NASHVILLE, TENN.

PROBABLY no greater change in the social condition of a people can be imagined than the transformation of a race from the state of slavery to that of freedom.

The colored people of the late slave-holding States have now been free for twenty-eight years; and their present condition in regard to health and mortality, as compared with that which prevailed before their emancipation, is an interesting question, not only to the physician, but also to the philanthropist and the student of social science.

It is almost, if not quite, impossible to obtain reliable vital statistics concerning the people of the Southern States outside the larger cities and towns; and it is only within a few years that even these have been complete and reliable.

In this article I shall consider only one disease, phthisis pulmonalis; but it may be well to remark that the general death-rate among the colored people in the southern cities, where statistics are attainable, is nearly twice as great as that among the whites.

I have made careful inquiries of many physicians who practised in the South before the late civil war, and it has been their universal testimony that pulmonary consumption was a comparatively rare disease among the slave population, some even affirming that it was entirely unknown. It would probably be safe to say that this disease was very much less frequent among the negroes than among the white people.

The prevalence of this disease at the present time will be seen from the statistics taken from the health reports of the following southern cities. The figures given represent the per cent of deaths from consumption, as compared with the total mortality from all causes; and also the proportion in 1,000 per annum.

	Proportion to Total Mortality.		Proportion in 1,000.	
	White.	Colored.	White.	Col red.
	Per cent.	Per cent.	Per cent.	Per cent.
Atlanta, Ga., 1892.....	9	18	1.7	7.7
Baltimore, Md.....	9	15	2	4.8
Charleston, S.C., 1892.....	8	13	1.2	4.9
Memphis, Tenn.....	10	21	1.8	5.8
Nashville, Tenn.....	11	21	1.5	5.1
St. Louis, Mo., 1890.....	9	18	Average 1.6	Average 5.6
Norfolk, Va., March, April, and May, 1893.....	16	17		
Twenty-five towns in North Carolina, Feb., 1893....	8	22		

It will be seen from the above table that the rate of mortality in proportion to 1,000 of population per annum is nearly four times as great among the colored people as among the white. It is probable, however, that consumption is much less prevalent in the country districts.

I will now consider some of the causes that have probably produced this excessive death-rate from this disease.

1. Unhealthy dwellings, often situated on narrow alleys, reeking in filth and moral and physical pollution. 2. Improper food, often of poor quality and lacking in quantity. 3. Insufficient clothing and exposure in inclement weather. 4. Irregular habits and a lack of a proper amount of sleep. 5. Excessive use of alcoholic drink. 6. Ignorance concerning the laws of health. 7. Lack of medical attention and good nursing.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.**

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Variation and Evolution.

No branch of the study of natural history is more interesting, or more likely to lead to valuable results, than that of the causes of the large amount of variation which is exhibited by many species of animals.

If, as seems certain, what were at first varieties, in the process of time, by increase of the differential characteristics, or simply by these becoming permanent, originated new species, we are, while studying the causes which favor these variations, at the same time gaining an insight into those of the origin of species themselves.

No class of animals offers more favorable conditions for this study than the terrestrial and fresh-water mollusca. The great variety of conditions under which many species live, and the numerous varieties into which they are divided, together with the ease with which they may be collected and kept under observation, make them peculiarly suitable for our purpose.

Darwin says in an extract from one of his letters which I have lately seen: "In my opinion, the greatest error I have committed has been in not allowing sufficient weight to the direct action of environment, independently of natural selection." Probably those changes which are commenced in a species by the influence of environment are, in process of time, fixed by means of natural

selection. That there is a preference exhibited for individuals of a like variety, even where the variation cannot be supposed to confer any benefit, may be proved by anyone who will observe the pairing of that most variable species, both in color and banding, *Helix nemoralis*, he will find, though with many exceptions, that among the pairs which he may discover by the roadside, soon after sunrise or in the evenings during spring and early summer, that there is a decided preference shown by these animals for individuals similar to themselves, the red varieties prefer to mate with those of their own color, as do the yellows; while, in a less degree, it will be found that the many-banded select mates among their own class rather than from the one-banded or unicolorous forms.

That in the majority of instances, at least, the progeny in those cases in which individuals of a similar variety have mated resemble the parents I have been enabled to prove by selective breeding. I am still continuing these experiments, and hope to have something further to say on the subject at a future time. Doubtless other species show preferences of this kind. I have referred, however, to those of which I have most experience. Is it not probable that *Helix hortensis* and *H. nemoralis* have been derived from a common form in comparatively recent times through varietal differences which have at last become specific?

Malacologists in America have opportunities denied to us in the old country. They have the great advantage of being able to study the variations, in introduced species, which have been produced as the consequences of that introduction.

As species introduced into a new country, under different climatic conditions to those under which they have previously lived, are in some degree similarly circumstanced to species living through climatic changes produced by alterations of land and water surfaces, etc., during the changes which all parts of the world have undergone during the long geological ages, we have in their cases a means of studying what changes certain conditions are able to produce, and consequently of gaining an insight into the causes which have helped to the development of our present fauna from their remote ancestors of the past. We can study the effects of a more equable climate in some parts, of greater heat or cold in others, of more and less moisture, of changes in the food-plants, of exposure to the attacks of new enemies, etc.

The more this subject is investigated, the more, I believe, will become apparent the fact that all species possess latent powers which the proper stimulus in the shape of altered circumstances, such as those suggested, is capable of bringing into action for the benefit of themselves and their descendants.

The observations at present recorded relating to the causes of variation are scattered through a large number of publications, these, in a short series of articles for another journal, I have endeavored to bring together and arrange for reference. Some of the causes which the various writers have assigned as probably inducing variation may be mentioned. Deficiency of lime in the soil produces thin, horny shells, and in some degree may cause change in their shape. Moisture, when deficient, is supposed to favor the formation of thick, white shells among the terrestrial mollusca, while its extreme abundance prevents the formation of colored bands in those species usually possessing them. Deficiency of light (as in dense forests) has been referred to as the cause of dull, unicolorous shells, while those more exposed to its influence are often gaily colored. Heat, combined with moisture, is considered conducive to brilliant coloring, with dryness as increasing the influence of the latter, while among the fresh-water species it tends to the production of fragile, dwarfed shells, overcrowding among the latter having a nearly similar effect. Dense vegetation, impeding the progress of aquatic species, has been considered a cause of scalariform varieties. Flowing and stagnant water are well known to effect the *Limnæidæ* to a large extent. Muddy, rocky, and sandy bottoms also have their effects. Food is undoubtedly an element of great importance in the manufacture of varieties in its relative abundance and luxuriance, while other circumstances have been observed where certain plants existed in unusual abundance. The presence of certain molluscan enemies has been found coincident with peculiar deformities, e.g., that of *Hydra viridis*, with deformed examples of a species of

Limnæa. Again, Mr. W. Doherty, writing from Cincinnati, records a remarkable dentate variety of *Conulus fulvus*; he further remarks that dentate species of *Helix* are the forms there prevalent, and points out that this formation is useful in obstructing the entrance of a grub which lives in beds of leaves and preys on small snails.

An American malacologist, Professor Wetherby, adduces evidence which goes far to prove that even malformations resulting from individual injuries may, under certain circumstances, be transmitted to the offspring.

In investigating these phenomena and their causes, I would suggest, first, that the manner of variation should be investigated and described, and, second, the exact nature of the surroundings as regards possible causes, always bearing in mind the conditions under which the species lives in its original home, and especially noting all deviations from these which may be supposed to induce the varietal character.

Among the species common to North America and Britain are the following: *Vertigo alpestris*, *V. edentula*, *Conulus fulvus*, *Helix aspersa*, *H. hortensis*, *Limnæa peregra*, *L. auricularia*, *L. stagnalis*, *L. palustris*, *L. truncatula*, *Physa fontinalis*, *Bullinus hypnorum*, *Planorbis albus* (= *P. hirsutus*, Gould), *P. glaber* (= *P. parvus*, Say).

W. A. GAIN.

Tuxford, Newark, England.

Books for Children.

IN answer to Mr. Waldo's request printed under the above heading in your issue of *Science* for June 16, let me suggest that such books as he desires are a desideratum not only for children, but for adults who, while not scientifically inclined, are yet interested in the wonders and beauties of nature. Unfortunately our attention has been too exclusively absorbed with the struggles and the problems incident to a new country for us to have time to educate the men who could study and name all our plants and animals, much less those who could translate scientific monographs into popular language. Especially in the insect world a good collector could bring in from any summer-day's excursion dozens of specimens which have never yet been christened.

But while we cannot hope for books which will enable us to attach names to everything we may find in a ramble through Nature's museum, most of the more conspicuous animals and plants have been studied, at least enough for this purpose, though the results have been put forth in scientific works. But on the stores of knowledge thus accumulated popular writers are beginning to draw to meet the demand created by our growing out-of-door life, our increased out-of-door interests. As was to be expected, plants have received the greater amount of attention. Mrs. William Starr Dana's "How to Know the Wild Flowers," just published by Charles Scribner's Sons, at \$1.50, is intended to teach one to identify the commoner flowers by color, size and shape of leaf, size of plant and so forth. Ten-year-old children would seem to me rather young to use such a book, but it is admirable for those of twelve or thirteen. Newhall's "Trees of Northeastern United States," published by G. P. Putnam's Sons, at \$2, teaches one to identify trees by the leaves, bark, and so forth. This I know from experience to be admirable for children. The same author is at work on a similar book upon shrubs, but I believe it is not yet out. I know of no such book on birds as the ones I have just suggested on plants. The best thing for children I believe to be Florence Merriam's "Birds through an Opera Glass," published by Houghton, Mifflin & Co., at 75 cents. The appendix to this little book contains lists giving form, color, size, habits, song, flight, nest, and so forth of our common birds. A fuller and altogether admirable book on birds is Minot's "Song and Game Birds of New England," published, I believe, by Casino, at \$2.50 or \$3. The best book on insects is one which Professor Comstock, of Cornell University, has in hand. It will probably be out now in the course of a very few months. Prepared especially for the school children of California, it is written in a manner attractive to children and will contain tables by which any insect may be traced to its proper fam-

ily. Farther than this it would be hardly possible for a child to go, as the characteristics on which genera and species are founded are often so difficult of observation that the best tables which could be prepared would be only a source of perplexity and worry.

After all the best method of teaching children is that which Mr. Waldo quotes as employed by his former teacher. And there are many books which occur at once to the mind of any teacher as valuable aids to the parent who wishes to work with his child. I have not named these because I understood the request to be for books which the child could use alone. But I should be happy at some future time to extend my list if it is not done by some other person better qualified for the task.

M. A. WILLCOX,

Professor of Zoölogy, Wellesley College.

Two Queries.

AN incident of a recent personal experience may interest those of your readers who are studying the subject of mimicry. On the 21st of May last, I was botanizing with two companions in the thinly populated sand-dune region at the south end of Lake Michigan, and about forty miles east of Chicago, when the event I am about to relate occurred. I was walking rather in advance of my companions across a level area that separated two series of high dunes, when I accidentally stepped upon two large snakes which were lying close together, doubtless enjoying the warm sunshine. It was a case of mutual surprise, and as the snakes, or one of them, suddenly sprang upward into unpleasant proximity to my face, I only a little less suddenly sprang backward, believing for the instant that I had encountered a rattlesnake. I soon discovered, or thought I did, that the reptiles were only fine specimens of the kind of black snake, popularly called the blue racer. One of the two had been considerably hurt by my heavy tread, and with violent contortions of his body made what haste he could to a hole about six feet distant, and disappeared in it. The other was uninjured and crawled rather leisurely away in another direction to a distance of twenty feet or more, and then lay quiet, watching our movements. Irritated by the violent start I had received, and cherishing no great love for snakes in general, I seized a club, and, while his snakeship lay broadside to me, I aimed a vigorous blow at him. I was again surprised, even more so than before, though in a different way, for with lightning rapidity the lithe reptile dodged the blow which otherwise would have struck him near the middle of the body, and instantly threw himself into a coil precisely resembling that of a rattlesnake when about to strike, and shook his erected tail with such vigor and rapidity that it was scarcely more distinctly visible than the spokes of a bicycle wheel when propelled by a fast rider. At the same time a sound was emitted, less shrill perhaps, but continuous and distinctly similar to that produced by the rattlesnake. Whether the sound was produced by the very rapid vibration of the tail, assisted perhaps by its scaly covering, or whether it was a hiss produced in the ordinary manner, I am of course unable to say. So close was the mimicry that I was for the moment almost deceived into the belief that I had mistaken a rattlesnake for a racer. The illusion was soon dispelled however, for a stick which I threw at him hit him on the head and stunned him, and I then had the opportunity to scrutinize him closely and verify my first conclusion.

I have frequently heard of other constrictor snakes mimicking venomous ones, in fact have occasionally observed such mimicry myself, but never before in this species and never in such perfection. It would be interesting to know if others have observed the habit in this species.

On the same trip another fact of interest came under our observation. The region visited contains many ponds and lagoons, and in these turtles (mainly *Chrysemys picta*, Ag. and *Nanemys guttatus*, Ag.) abound. About these ponds, often many rods from the water, were the remains of hundreds of turtles that had evidently all been killed since the opening of the spring, and some of them within a few hours. The dead turtles varied in size from those with carapaces two inches long to those fully six inches in

length. It was clear from an inspection of those most recently killed, that they had been killed by some animal for food. The flesh of all had at least been partly devoured, but it was observed that not a carapace nor a plastron was broken. The reptiles had been killed, apparently, by some sharp-beaked bird, by thrusting its beak between the joints of the reptile's armor, so to speak. The loon is clearly competent to do this, but loons are seldom seen in this locality. Moreover these birds would hardly drag their prey so far inland to devour it, as was observed to be the case with many of the turtles. The blue heron is more abundant here than the loon, but still not abundant enough to be credited with so much destructive work on animals so large. I have never suspected him, either, of being a turtle-eater. The only other birds competent to do the work and sufficiently numerous and intelligent to be suspected, are crows. Several flocks of these were hovering about the locality, and though we were not able to approach the wary birds close enough to observe them feeding, our suspicions fell upon them. Has any reader of *Science* observed crows killing turtles? If so, is this a well established habit of the bird or is it one which has been recently acquired?

EDSON S. BASTIN.

Chicago, Ill., 2421 Dearborn Street, June 14.

The Aurora.

DR. VEEDER'S reply of June 2nd, is so objectionable on account of the positive way in which he closes his part of the argument (believing, as I do, that his facts are in fault) leaving it to be believed that at "no point throughout the research has there appeared to be even the slightest 'chance' for an alternative hypothesis," that I am once more tempted to reply. Let me, before passing on, emphasize the fact that we are not discussing the question of "magnetic storms" and sun-spots. I believe there is only one astronomer and physicist of any eminence who disbelieves in this association, so that as far as discussion of the question is concerned, we may consider it as practically closed; but, even if I held the contrary opinion with the majority, so long as an opponent of such eminence held out, I should consider it inadvisable to be as positive as Dr. Veeder in his last letter, on the subject of the aurora, where, I believe, I am not alone in supposing there is reason to doubt a connection between this display and areas of disturbance on the eastern limb of the sun. I have raised some well-known objections to this theory, and, as a rule, have been met by Dr. Veeder with generalities (*Science*, April 7, 28, May 19 and June 2); it is unnecessary to mention them again here, so that I shall content myself with discussing this last contribution, which leaves me in such an uncomfortable position, apparently.

The whole base and superstructure of this theory is erected upon a solar period of rotation of "27¼ days," and to quote from a letter which I have received from Dr. Veeder, dated March 16, 1892, the addition of "a few hours difference in the length of the period introduces a drift into the tables that becomes everywhere apparent." Surely this is a suspicious degree of perfection in the theory, as no one knows what the solar period of rotation is: such periods as have been determined from sun-spots (the only possible method so far) give values between 25 and 27¼ days, depending on the solar latitude of the spot; yet, the addition of a "few hours" can introduce a "drift which becomes everywhere apparent," when 2½ days is left out of the tabulating without apparent effect, for, it is evident, that in considering the effects of the return to the eastern limb of a sun-spot or area of disturbance, that it is not a fixed rotational period that should be used, but the one belonging to the latitude of the spot under discussion.

This year auroras were visible here on the following days of the year: the 5th, 6th, 8th, 21st, 35th, 36th, 44th, 45th, 46th, 47th, 104th, 109th, 127th, 128th, 130th, 144th, 145th, 160th, 164th, 165th and 166th. If auroras are caused by a disturbed solar area at the eastern limb, we should find, by adding the interval adopted by Dr. Veeder of 27¼ days to any of the above days, the probable date of the returning display. What do we find in fact? That, of the 52 periods obtained by adding this interval in suc-

sion to the above days, up to the present date, there were only 10 of the days so determined on which displays took place; that is, 20 per cent of successes as against 80 per cent of failures. In illustration of the above, the aurora of the 5th day should have reappeared on the 32½, 59½, 86½, 114 and 141½; from the days of auroras given above, it will be seen it appeared on none of the required dates; nor did that of the 6th; that of the 8th reappeared twice out of five solar periods; the 21st, once out of five; the 35th, once out of four, and so on.

One more objection, previously overlooked, before passing on. I am of opinion (no one can be certain, failing the necessary observations), that there is practically no instance in which aurora displays are not taking place in one hemisphere or other of the earth; a large proportion should be observed co-incident with any other class of recurrent phenomena, and think it possible that "chance," which Dr. Veeder avoids the discussion of, is really an important element in our discussion, as I shall now endeavor to prove this by his own admissions.

In a letter to me, dated May 4, 1892, he says: "The year 1879, selected for printing as an illustration of the results seen throughout the entire table, is one of profound minimum at which times solar disturbances are well separated from each other and the relation *comes out distinctly* although for the construction of such a table one year is just as good as another." (*italics* are mine.) This is a perfectly sound conclusion, and by it alone might this theory stand or fall if "chance" is not, or is, as important as I maintain. On May 13th, Dr. Veeder writes: (This table of comparison between the phenomena being now printed) "It [1879] being a year of minimum the relation *does not come out so strongly as when disturbances were more numerous*. In the next year (1880) the numbers would be much larger and the relation in every way more distinct."

So far, then, Dr. Veeder has been about equally positive on both sides of this question, both of which opinions are apparently obtained from the observations he is in possession of, leaving the possibility open (it is his suggestion) that we are very far from "a realizing sense, that it is *facts* and not a personality against which" we "are contending."

Might I again suggest the advisability of setting a limit on the term "eastern limb," adhering *rigidly* to it throughout the investigation, not admitting too much of the suppositional when sun-spots fail at the required period by the substitution of "faculae," and seeing how far the element of "chance" enters into this question by showing a continuous series of comparisons through a semi-period, at least, of solar activity.

W. A. ASHE.

Quebec, May 17.

Scientific Words in the Century Dictionary.

ALTHOUGH one of the most useful books published, the Century Dictionary is, of course, not faultless. The mention of a mistake in a recent issue of *The Critic* reminded me also of the following:—

According to the latest edition of Foster's "Physiology," saliva "in a healthy subject is *alkaline*, especially when the secretion is abundant. When the saliva is scanty, or when the subject suffers from dyspepsia, the reaction of the mouth may be *acid*." According to the Century Dictionary, the saliva "is a colorless ropy liquid which normally has an acid reaction."

The word "griffe," which is commonly used in Louisiana, is defined by the Century Dictionary as a "a mulatto—especially a mulatto woman." I have copied in a note-book from a lecture delivered in New Orleans by Hon. Charles Gayarré, the historian of Louisiana and authority on such matters, the following:—

"In Creole America there is a very mixed population. Even in very early times there were these distinctions: European, or fresh white immigrant; Creole, or pure white American of European parentage; the aboriginal Indian; the *griffe*, or cross between Indian and negro; the mestizo, or mixed white and Indian; the mulatto, etc., etc." These may not be the exact words of the speaker, since I may have misunderstood or copied it wrongly, but I think the same statement may be found in one of his works. Griffe, no doubt, is from the Spanish *grifos*, meaning frizzled

hair. This is a peculiarity of many of the crosses between Indian and African. I need but mention the Cafusos, who, according to Tyler, "are remarkable for their hair, which rises in a curly mass, forming a natural periwig, which obliges the wearers to stoop low in passing through their hut doors."

The word *playa* is not mentioned in the Century Dictionary, although, according to the *Popular Science Monthly*, vol xxii., p. 381, it "has been adopted by geologists as a generic term, under which the various desiccated lake-basins of the West may be grouped."

Although the *æse*, or *platinum-needle* or *loop*, is the most important tool of the bacteriologist, both of these words have been omitted. The word *æse* is, of course, German, but is now much used in English books.

The common names, and often the scientific names, of well-known plants have been omitted. The *Amorphophallus titanum*, a vegetable wonder of the Arum family, discovered in Sumatra in 1878 by Beccari, is not mentioned under its generic or common East Indian name of *Krubut*, although both of these appear under *Rafflesia*, the generic name of a remarkable plant which grows with it.

The word noctilucous is defined in the Century Dictionary, but the word noctilucence, a term sometimes applied to the light emitted by the *Noctiluca*, is omitted, although phosphorescence is the more common, but perhaps less accurate, term.

Many of the definitions are inaccurate and unsatisfactory. From the following definition of Carib, one would conclude that they are all of a "native race" and that none are living in the Caribbean Islands at the present time: "One of a *native race* inhabiting certain portions of Central America and the north of South America, and *formerly* also the Caribbean Islands." According to the latest Handbook, in British Honduras, there are 2,200 Caribs who, "although to all appearance of true African origin, being a black and woolly-headed people, are a mixed race of the aboriginal Caribs, with a large percentage of African blood." A few true Red Caribs and some Black Caribs still live in the Windward Islands. The true Caribs are not natives of Central America. They inhabited the northern part of South America and the Caribbean Islands, and, according to Dr. Brinton, their original home was south of the Amazon. JOHN GIFFORD.

Swarthmore College, Pa.

A Peculiar Occurrence of Beeswax.

In *Science* for June 16, 1893, Mr. George C. Merrill, of the U. S. National Museum, has a request for information under the above heading concerning some beeswax forwarded to him from Portland, Oregon. He describes it as having all the elements and characteristics of beeswax, but says, "such it would have unhesitatingly been pronounced but for certain stated conditions relating to its mode of occurrence."

He says it occurs in the sand along the beach, at quite a depth in places, and in a fragment of sandstone, etc., and further says: "Tradition has it that many hundred years ago a foreign vessel (some say a Chinese junk) laden with wax was wrecked off this coast. This at first thought seems plausible, but aside from the difficulty of accounting for the presence in these waters and at that date of a vessel loaded with wax, it seems scarcely credible that the material could have been brought in a single cargo in such quantities nor buried so deeply over so large an area."

The first difficulty Mr. Merrill seems to encounter is the presence of a vessel of that supposed nation on our coast at so early a date. This should give him no difficulty whatever, for Hon. Horace Davis, of California, in an article before the American Antiquarian Society, April, 1892; Charles Walcott Brooks before the California Academy of Sciences, March 1, 1875, and Professor George Davidson, of the U. S. Coast Survey, for thirty years or more last past, have all been calling attention to the hundreds of known wrecks of Japanese (not Chinese) junks cast on the American shores, from Behring Sea to Peru, by the "Kuro Shiwo," or black stream of Japan.

In both the articles mentioned above you will find an account of the "beeswax junk" and so much information concerning it

that Mr. Merrill's doubts will be dissipated; if not, Professor Davidson, in the "Coast Pilot of California, Oregon and Washington Territory," 1869, describes this very junk and the very beeswax in question.

Mr. Merrill's informant, however, seems to have fallen into an error as to the quantity and locality of this wax; for no such quantities were ever found as those mentioned in *Science*; in fact, the story is this: At some recent—but prehistoric—time a Japanese junk loaded with beeswax was thrown ashore at or near Clatsop beach, Oregon, and the cargo was scattered along the sands and buried therein, where it is found even today in small quantities and that is all.

Mr. Merrill's letter to *Science* is published, he says, "in the hope of gaining more information on the subject," and I will be fully repaid if through the instrumentality of this note he shall have obtained that information.

Many Japanese wrecks have been thrown ashore on our coast, of which we have authentic information, all the proof of which has largely been collected by the eminent gentlemen quoted above.

JAMES WICKERSHAM.

Tacoma, Washington, June 26.

Color Perception: A Correction.

I HASTEN to send this note of correction to my paper on "Distance and Color Perception by Infants" in *Science*, April 28—an error brought to my attention by a friend. In Tables I. and II. of that article (p. 231) I have taken the proportion of "acceptances" to the entire number of cases (the ratio $\frac{A}{N}$) after adding up the simple numbers for each color at all the distances. It is evident that the resulting percentages are wrong as representing comparative results for the different colors, since there are not an equal number of cases for each same color at different distances, nor for the different colors at each same distance. The proper method is, of course, to compound the percentages representing the relative attractiveness of each color at each distance. This gives the values (for $\frac{A}{N}$) in Table I.: Blue, .78; red, .75; white, .78; green, .68; brown, .43; and in Table II.: Newspaper, .76; color, .71. This brings white up to the level of blue and red. The same correction should be made for the values $\frac{R}{n}$, but in the result it is immaterial.

I wish to add, also, that I do not consider the results relative to the individual colors of much value, since the cases are so few. The experiments had to be broken off unexpectedly. I published the tables mainly to illustrate the working of the method of experimenting. For this reason I did not enter in my article into side considerations, such as color-brightness, fatigue, etc., which were duly provided for in the experiments themselves. I hope to discuss such points in the fuller treatment of the monograph on the infant's active life which I am preparing.

J. MARK BALDWIN.

Princeton, N.J., June 30.

Birds that Sing in the Night.

I have read with a great deal of interest the notes under this head as they have appeared in *Science* from time to time. While some species have been mentioned that I have not heard, there are also some not mentioned which are night singers in central Iowa, where I have spent many years studying the birds in their various moods and conditions.

The first in point of beauty of execution is the wood-thrush (*Turdus mustelinus*). Not only does he sing in the night, but his song is given at shorter intervals and more earnestly than during the day. It is rarely that he sings at high noon, unless the day be dark and wet. Nor does he sing all night long; from midnight until after two, there is only an occasional burst of song or none at all.

Second in point of regularity and persistence is dickcissel (*Spiya americana*). Not only does he sing at short intervals all

day long, but he prolongs his day far into the night. By day his song is not very musical, but at night it seems softened and subdued almost to sweetness. The country boys call him the "sheep-sheep shear-shear-shear" bird, as an imitation of his song. The first two notes are uttered sharply with a considerable pause between them then, the last very rapidly — nearly run together.

Two other birds are not uncommon night singers — the grasshopper and henslow's sparrows (*Ammodramus s. passerinus* and *A. henslowi*), especially the latter. His modest little song is so drowned out during the day by the larger birds that he must sing at night if he be heard at all. I have often heard his note well into the night.

There is one winter night singer, the chestnut-colored long-spin (*Calcarius ornatus*). As one wanders over the snow-clad hills on some frosty night, he may near the clear *chee-ho* of this bird starting from the snow where he lies hidden.

LYNDS JONES.

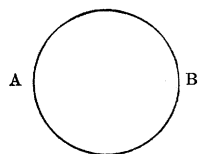
Oberlin, Ohio.

The Earth as a Conductor.

In reference to the communication on the use of the ground in an electric circuit, June 16, you may allow me to say: The earth is not a conductor of electricity in any sense, only as a convention. All Du Moncel's measurements, and they were many, gave the resistance of the earth as about 100 ohms. This resistance is negligible in long circuits, telegraphic or telephonic, but not in short circuits.

On the principle of contact electricity (see Ayrton and Perry, Jenkins or Gorden) it was wrong to place a copper plate at one end and a tin plate at the other, as their contact or connection by wire would produce a current along the wire. Nor was it proper to put charcoal or carbon or iron around either plate on the same principle. Both plates, preferably, should be of copper surrounded by sulphate of copper. There is considerable resistance offered in the passage of a current from one kind of material to another (see Jenkin *passim*).

The earth may, for convenience, be called a reservoir of electricity, but its quantity is always constant and no electricity can be taken from it at one point without putting an equal quantity into it at another point. The action or roll of the earth in the circuit is like this. Consider a lake of large dimensions with a



lift and force pump at A connected with a pipe which crosses the lake to B; the water lifted at A and forced over to B falls into the lake, but not a drop of it ever gets back to A.

If you will consider a ground wire in a large telegraph or telephone office with a number of circuits of variable resistances and different polarities attached to it you will see that it is absurd to say that a positive current from one battery goes down that ground wire and off to a distant point while at the same instant a positive current from a distant battery comes up the same wire. That is the common sense view of it, and it is supported by Kirchhoff's law, $\sum C = 0$, or the sum of all the E M F's or currents meeting in a point equals nothing. In fact, the ground wire in a large office may be cut (as I have often seen it done for experimental proof) without stopping communication. When three or more wires are joined to the same ground either one of the wires acts as a return wire for the others when the ground wire is cut. But when all are open at once, then the ground comes into play to form the circuit for the first one that closes. It is also useful as a regulator of current, but the manner of doing this is not properly introduceable here.

If nothing had been said of the use of tin at one end and copper at the other the resistance of 102 ohms as found would indicate a good ground. But as some current probably arose from

their use, doubt is cast upon the measurements. Still, on the whole, the ground was as good as is usually made.

One hundred ohms' resistance in the earth circuit under all circumstances should be reckoned on and may be regarded as a constant.

D. FLANERY.

Memphis, Tenn., June 30.

On the Evolution of the Habit of Incubation.

It may be stated as a general rule that harmless snakes produce their young by means of eggs, while poisonous serpents are viviparous, to which fact they probably owe their generic appellation of "vipers." The oviparous snakes, like most other reptiles, deposit their eggs in a sunny spot, and never trouble themselves about the incubation, but leave the eggs to hatch out as best they may under the influence of the sun's heat. There is, however, a very curious though authentic instance on record of a caged python, in the *Jardin des Plantes*, at Paris, which hatched out her own eggs. She laid fifteen in all, and then coiled herself around them, and so incubated them in much the same manner as a setting hen, her temperature being observed to increase perceptibly during the period.

This strange fact, whether an anomaly or whether a natural habit of the pythons, seems to throw considerable light on the evolution of the habit of incubation, so universal among birds, for it must be remembered that the bird is closely allied to the reptile, and is in fact but a higher form of the type. This relationship is clearly shown by the study of the morphology of the bird's organs, for every part of a bird's body is but a modification of the corresponding part of the reptile; it is also shown by the fact that birds are found in geological strata immediately after the reptiles, and hence must have appeared upon the face of the earth at a later period. Were any further proof necessary, it is furnished in an irrefutable manner by the science of embryology, for the bird passes in the egg through all the reptilian stages of development before it is finally hatched out in its perfect form.

This being the case, we may rest assured that the habit of incubation has been evolved at some time during the evolution of reptiles into birds, and hence this case of the python hatching its own eggs acquires exceptional interest.

We may premise that the habit could never have been evolved unless it were of some value to the species, but we must at the same time admit that the incubated egg would in all cases hatch out far in advance of that heated only by the sun, hence those individuals which thus appeared earlier than their brothers ran a better chance of surviving in the struggle for existence. So far, so good, but how did the habit originate? What first led snakes or other reptiles to think of hatching out their eggs? That it was not intelligence we can safely assert, for all who have had any experience in keeping snakes, agree in stating that their intelligence is of the lowest order. I am therefore inclined to believe that what first led animals to incubate their eggs was the heat developed in the egg during the process of hatching. Snakes are exceedingly fond of heat, in fact I have known them to injure each other in cages in the attempt to retain the warmest places. Hence we can infer that if, when basking in the sun, a snake chances to lie near its eggs, especially if these have already begun to hatch, it will soon feel their heat and so be led to coil more closely about them, and while thus warming itself it will at the same time hasten the process of incubation.

The next question that arises is, how this habit of incubating her eggs, even when thus acquired, will be transmitted to the offspring, for if not transmitted, the habit could never become general.

So little is known of the principles of inheritance that we cannot hope to solve this problem at present. Even Darwin, who made a life-long study of the subject, and to whom we are indebted for the ingenious theory of *pangeneses*, was forced to admit our abject ignorance of the laws of transmission of characters from parents to children. We can, however, infer that those serpents most susceptible to the cold would be most likely to remain by their eggs, and this susceptibility to cold would tend to be inherited by the young

Moreover, when we remember what unexplainable cases of inheritance occur, such as special movements during sleep, we must admit that even the tendency in a snake to incubate its eggs may also be transmitted, the more so as we have an indisputable inheritance of the same nature daily shown us in the case of birds, for the tendency of the parents to incubate their young is in all cases inherited by the offspring.

CLEMENT FEZANDIE.

686 Lexington Avenue, New York.

Another Ancient Argillite Quarry Near Trenton,

ON the left bank of Neshaming "Creek," Bucks County, Pennsylvania, about three-fourths of a mile above the mouth of Labaska or Mill Creek, I discovered at the base of the cliffs of metamorphosed slate that there overhang the stream, on June 23, another ancient work-shop where blocks of argillite, lying *in situ*, have been chipped into "turtle-backs."

A layer of chips, hammer-stones, and the now familiar rude leaf-shaped forms is laid bare for several hundred yards where the stream has worn away the margin. The blocks of workable stone in various instances show peckings upon their sides, as do similar specimens at Point Pleasant, inferably made by the ancient workmen to split them with the grain.

No search has yet been made for diggings and refuse-heaps higher up the slope, nor has excavation been made into the exposed layers; but thus far the story of the workings on Gaddis' Run, near Point Pleasant (Bucks County, Pennsylvania), discovered on May 22, seems to be repeated, though on a smaller scale. There we were twenty-five miles from Trenton; here we are but fifteen.

H. C. MERCER.

Do Nestlings Drink.

This question suggested itself to my mind very lately, when I observed the following, and to me, entirely new fact:

A piazza-roof, on which my windows open, is provided with a

shallow gutter, in which there is a considerable accumulation of the winged seeds from a neighboring tree. These were standing in shallow water, left there by the recent rains.

I observed a robin alight on the roof, and noticed that she picked from the gutter a bunch of those seeds, which she held in her bill while she seemed to be preparing to fly away.

Presently, apparently dissatisfied with what she had picked up, she dropped the seeds, and moving to a place where they were lying in a thicker bed, she gathered a much larger mass of them, about as many as her bill would hold together. After gathering them and satisfying herself that she had enough, she deliberately dipped the mass into the water and flew away with it to a distant tree. Perhaps some of your readers may suggest a truer explanation; but to me she seemed to be carrying a supply of water to her brood in what was no inadequate substitute for a sponge.

FRANCIS PHILIP NASH.

Geneva, N. Y., June 28.

BOOK-REVIEWS.

Logarithmic Tables. By PROFESSOR G. W. JONES. Ames, Iowa, the Author.

THE title of this book does not exactly describe its contents. The strictly logarithmic tables are only about one-half of those given. The arrangement of the tables, of which there are eighteen, has been made to meet the wants of those who desire to have, in a handy form, tables to be used in computations covering a wide range. Table I. is a four-place, of numbers from 1 to 1,000, followed by one of the same accuracy giving the six principal trigonometric functions, and of the lengths of arcs in radians. The first five degrees of the quadrant are given to each five minutes, the following to each ten minutes, with differences for single minutes. A table giving the squares, cubes, square-roots, cube-roots, and reciprocals of the numbers 1, 2, 3, 99 is also given. Table III. is a six-place table of numbers, the side numbering being carried to only three figures instead of four, as is usual in

CALENDAR OF SOCIETIES.

Agassiz Scientific Society, Corvallis, Ore.

June 14.—Dr. Pernot, Aphasia.

Reading Matter Notices.

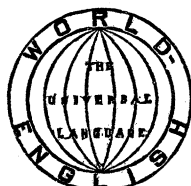
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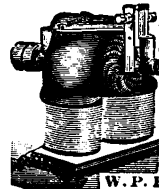
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such tables. In Table IV. will be found all of the useful constants used in mathematics, chemistry, engineering, physics, and weights and measures. This table is a very complete one, containing, as it does, reference to almost every standard and constant used in the arts and science. Table V. is a reprint of the Gaussian six-place addition-subtraction logarithms. For determining trigonometric functions, there are two tables, the four-place already mentioned, and also a six-place table. The latter is a departure from the usual method. Generally, in a six-place table, the functions are given for each ten seconds. Professor Jones has made up the table for each minute of the quadrant, the proportional part being given for each second. The tables that follow those just explained consist of prime and composite numbers, squares, cubes, square-roots, cube-roots, reciprocals, and quarter-squares. Finally, we have Bissel's table of coefficients for interpolation, and a table containing the integral for finding the mean or probable error of a result in least squares. We judge from our examination that Professor Jones has prepared the tables with great care. He seems exceedingly anxious to free them of all errors, and to induce that condition of things he offers a reward for an error found in the tables. We have not critically examined the tables, but we note a slight error in the text. On the first page the reference to the pages containing Table IX. should read 118-133 instead of 114-133. We would commend these tables to the computer as being a help to have on one's desk.

G. A. H.

Pioneers of Science. BY OLIVER LODGE, F. R. S., Professor of Physics in Victoria University College, Liverpool, with Portraits and Illustrations. London, Macmillan & Co. 404 p. 8°. \$2.50.

In this work, Dr. Lodge has given the general public and the student a very interesting and readable book. As he states in his preface the book had its origin in a course of lectures on the history and progress of astronomy, delivered by the author in 1887. As is often the case with books based on a course of lect-

ures, it is somewhat disjointed. It is full, however, of interesting matter, and is lavishly illustrated, an unusual feature in works of this class. Its title is unfortunately misleading as the author does not attempt to cover the whole growth of scientific knowledge, but confines himself to astronomy. The book, however, is unique in the endeavor by means of plain, unaffected writing and a wealth of illustration to bring the pioneers of celestial knowledge into almost personal acquaintanceship with the reader, tracing the history of their discoveries and the dependence of one discovery upon another. It is to be commended to students of the history of science as a most useful reference book, and to the general reader as a book at once entertaining and instructive.

J. E. I.

AMONG THE PUBLISHERS.

THE career of the late Sir Richard Burton, the distinguished traveller, was most adventurous and romantic. He was an encyclopædic scholar, and much more than a scholar. He knew and had seen more of dark Africa than most men, and more of Mohammedan lands than any man. His biography, by Lady Burton, will be published shortly by D. Appleton & Co. The book will be decorated with illustrations and maps, as well as portraits. The first part of the story, it is said, will in the main be told in Sir Richard's own words.

—The weekly paper known for the last twenty-five years as *The Christian Union* with its first issue for July changes its title to *The Outlook*. It will remain unchanged in other respects, except in the line of improvement and enlargement. It will be, as before, a family paper, non-denominational in religious matters, and giving large space to the current history of our times; to literature, economics and progressive movements of all sorts, and to home life. The Rev. Dr. Lyman Abbott will remain as its editor-in-chief, with Mr. Hamilton W. Mabie as his associate, and an editorial staff of several members.

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I wish to exchange a collection of 7,000 shells, 1001 species and varieties, American and foreign, land, fluviatile and marine, for a good microscope and accessories. Address, with particulars, Dr. Lorenzo G. Yates, Santa Barbara, California.

For exchange.—I wish to exchange Lepidoptera of South Dakota and other sections, for Lepidoptera of the world. Will purchase species of North America. Correspondence solicited, particularly with collectors in the Rocky Mountains, Pacific coast and Hudson's Bay regions. P. C. Truman, Volga, Brookings county, South Dakota.

For sale.—Wheatstone Bridge wire, made to order, new and unused. Price, \$10. W. A. Kobbe, Fortress Monroe, Va.

For sale or exchange.—One latest complete edition of Watt's Dictionary of Chemistry, in fair condition; one thirty volume edition (9th) of Allen's Encyclopædia Britannica, almost new. Will sell cheap for cash or will exchange for physical or chemical apparatus. Address Prof. W. S. Leavenworth, Ripon College, Ripon, Wis.

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W ANTED.—A set of Allen's Commercial Organic Analysis, 4 vols. Vols. I and II particularly desired. Condition not important, all leaves being present and in place. Address Charles Platt, 34 Lewis Block, Buffalo.

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W ANTED.—A young man as assistant in our microscopical department. Queen & Co., Philadelphia.

T HE undersigned desires specimens of North American Gallinae in the flesh for the study of their pterylosis. These species are especially desired: *Colinus ridgwayi*, *cyrtonyx montezumae*, *deudragapus franklini*, *lagopus velchi*, *tympanuchus cupido* and *pedioecetes phasianellus*. Any persons having alcoholic specimens which they are willing to loan or who can obtain specimens of any of the above are requested to communicate with Hubert Lyman Clark, 3922 Fifth Avenue, Pittsburgh, Pa.

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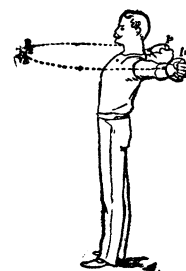
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